AAPG Annual Convention
Salt Lake City, Utah
May 11-14, 2003

Donald F. McNeill, RSMAS-University of Miami, Miami, FL

Core-to-Log Calibration and Permeability Distribution in Eocene Peritidal Carbonates, South Florida Basin

Core measurements and Formation MicroScanner (FMS) logs are used to develop a permeability model of middle Eocene peritidal carbonates buried to intermediate depth (>750 m). Four high-frequency sequences (HFS) within the subsurface Avon Park Formation are recognized regionally based on natural gamma-ray log signature. These regional-scale cycles likely formed in response to sea level changes—related to rate of accumulation and preferential dolomitization on the initial transgressive and the regressive parts of the cycle. The basal HFS has been examined in detail to relate core lithofacies and permeability to log signature, especially results from the FMS log. Core descriptions indicate six lithofacies (grainstone, packstone, algal-laminated wackestone, root-trace wackestone, wackestone/mudstone, and subaerial exposure). A lithofacies-permeability relation was developed with over 400 permeability measurements using the ExxonMobil mini-permeameter. Results show a well-defined permeability range for each lithofacies. High-resolution permeability profiles were then generated for cored intervals that had FMS coverage. These permeability profiles were in turn correlated to their respective FMS logs. This comparison provided a calibration between permeability and microresistivity-based FMS images. The lower ''transgressive'' part of the HFS has a greater percentage of ''high'' and ''very high'' permeabilities but displays a decreasing upward trend. Conversely, an increasing upward trend in ''medium'' permeability beds occurs, indicating generally lower permeabilities in the upper ''regressive'' part of the HFS. FMS classes with ''low'' permeability show no apparent vertical trend. These calibrated results suggest that a resistivity-permeability relation exist—still strongly influenced by the original depositional lithofacies. Diagenetic factors have had little influence on petrophysical properties, save the relatively thin, dense dolomite found at the basal sequence boundaries and those possibly related to HFS boundaries.